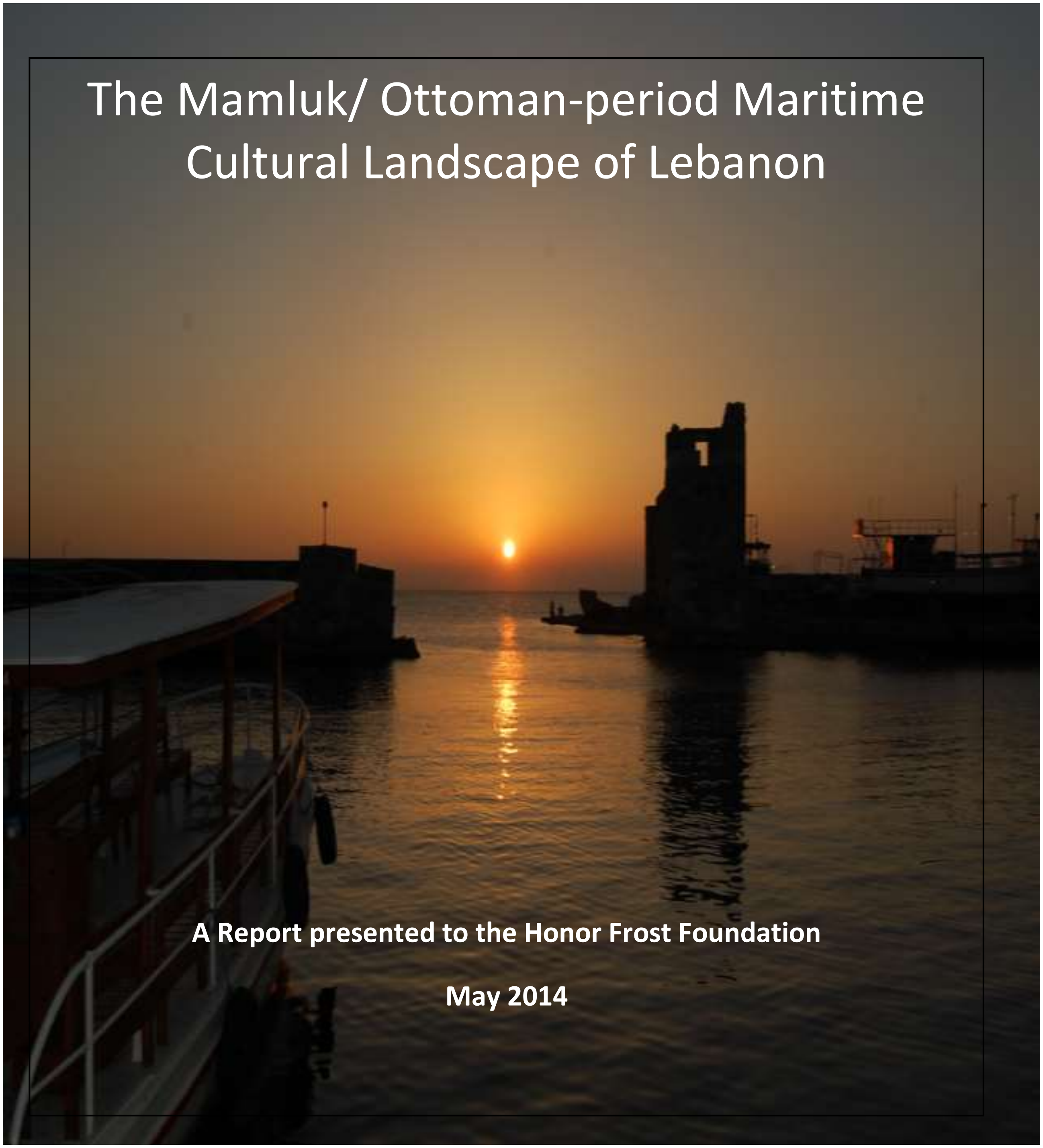
The Mamluk/ Ottoman-period Maritime Cultural Landscape of Lebanon



A Report presented to the Honor Frost Foundation

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Abstract

This project undertook an assessment survey of Ottoman-period maritime archaeology in Lebanon. It constitutes one section of a larger regional study investigating the coastal archaeology of the Eastern Mediterranean and Red Sea from 1500-1850. There is an increasing level of research being undertaken on Bronze Age and Classical period sites across this region but little work has been conducted on the archaeology of later periods. This initial section of the broader project undertook coastal archaeological survey at a number of landscapes centred on the historic ports and maritime hinterlands of sections of the Lebanese coast recording medieval and Ottoman period archaeology and coastal architecture. An analysis of museum collections was also conducted to assess the coastal histories and material culture of this period. The project adopted an integrated approach and includes an assessment of the physical coastal processes affecting the maritime cultural resource of this area. It is anticipated that our findings will contribute to the development of broader understandings of maritime societies during this period and help to plan and develop better strategies for the protection, management and interpretation of this resource.

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Introduction

In January 2014 a small team of archaeologists and coastal scientists undertook a reconnaissance survey of sections of the coastline of Lebanon. The project was funded by a small grant from the HFF. This project was developed as part of a broader research theme examining the archaeology of later historical coastlines across the Eastern Mediterranean and in parts of the Red Sea. The central research question was:

Can we construct a regional maritime archaeology of the Ottoman Empire across the Eastern Mediterranean?

An historical Context

While there have been extensive studies on the archaeology of the prehistoric and Classical periods across the Eastern Mediterranean there have been few studies of the periods following the collapse of the Byzantium world. The section of coastline that now constitutes Lebanon underwent significant change during the 7th century. A series of earthquakes had hit the coastline during the 6th century and both the structural loss that incurred during these events and wider political changes made this region susceptible to the Arab conquests of the 630s. The 551 earthquake and subsequent probable Tsunami destroyed much of the settlement at Beirut and other coastal cities. Baalbek was the first settlement to fall militarily in 635 and the conquest was complete by 637. Islam was now widely adopted and Arabic became the language of the administration. Over the following decades the coastal cities underwent a period of revival while large programmes of irrigation led to a significant expansion of the agricultural industry in the hinterland. The Omayyad city of 'Anjar is largely typical of this revival and this period sees the building of fortifications, shops, palaces, a mosque and the laying out of a new street pattern. With the advent of the Crusader period Lebanon's coastal strip was incorporated into two Crusader kingdoms (1098-1289) although the inland territories remained under Ayyubid control. The northern section of the coastline became part of the Country of Tripoli while the southern section was incorporated as part of the marches of the Kingdom of Jerusalem. The most visible manifestation of this occupation was the construction of a series of citadels from Tripoli to Tyre.

The Ottoman Empire emerged from Anatolia in the fourteenth century and at its height controlled extensive territories across the Middle East and North Africa. Historically the empire has been well documented but the archaeology of this period across these regions has been understudied. The limited research that has taken place has focussed on rural settlement in southern Greece, Crete and parts of Cyprus while a number of military installations along the inland trade and pilgrimage routes have also been investigated. The coastal zone has been subject to less directed research. Yet we know that the maritime region administered by the Ottomans was a dynamic zone with trading activity facilitated by widespread maritime traffic. However, little is known about the physicality of these trading and marine communication systems. Some limited evidence of the physical infrastructure that was built to facilitate this activity has been found. From 1975 to 1990 civil war caused extensive damage to Beirut. During subsequent major excavations in the city centre, a sequence of Ottoman period seawalls was uncovered (Seeden and Thorpe 1997). There was a degree of conformity in public architecture following imperial design that can be seen in mosques and schools and other building types - but was there a similar investment in coastal infrastructure? Can we identify specific investment in harbour installations, storage places and the houses of the merchants who conducted coastal trade? How were coastal fortifications, many of which were originally built during the Crusader period, modified to reflect the interests of the new order? What corresponding changes took place in boat and ship design that reflected the changes brought in by the new regimes? Lebanon is an interesting case study in this regard

as it had a degree of autonomy during the Ottoman period and reflects well the continuities and disconnects that occurred in this area following the defeat of the Mamluks in the sixteenth century. This project is not just concerned with the buildings and vessels of the political and mercantile elite but aims to investigate the settlements of artisans and fishers who lived along this coast. Many examples of Ottoman vernacular architecture survive built using the 'pier and rubble technique', a distinctive regional style (Schriwer 2002). However, these structures are under constant threat as modern development and rebuilding destroys many prime examples. The identification of these historical archaeological horizons will contribute to our broader understandings of maritime societies during this period and help to plan and develop better strategies for the protection, management and interpretation of this resource.

This pilot project will build on the work the applicants have already undertaken along the west coast of the Red Sea and at both Alexandria, Egypt and Sousse, Tunisia. It will extend analysis of the Ottoman period coastal zone to Lebanon and later to parts of Cyprus providing a key research focus on the maritime contact zone or economic interface between land and sea. The archaeology of Ottoman period coastal landscapes and ports is the central component of the research while other key variables include boats, ships and their associated material culture. While much of Honor Frost's work focussed on the Bronze Age she remained interested in the archaeology of all periods across the region. This project provides an innovative opportunity to begin to develop integrated understandings of the maritime cultural heritage of the more recent past in the Eastern Mediterranean. It will also begin to investigate the very tangible and visible archaeology of this period that will in turn aid the development of country-based educational and heritage management programmes that will support sustainable development of Lebanon's coastal zone.

Methodology and project management

This project undertakes a four staged approach to the analysis of the Ottoman maritime cultural landscape. An initial desk-based assessment of Ottoman period archaeology across the region is ongoing. This includes a detailed overview of all published articles in both archaeological and historical journals as well as an analysis of the marine physical processes that affect the region in the relevant coastal and marine journals.

The second stage consists of an ongoing assessment of both published and grey literature associated with historic and contemporary excavations. This will include detailed interviews with archaeologists who have worked in this landscape. As a result of this literature review and interviews a landscape and site potential map will be generated and used as the primary baseline for future targeted field visits.

The third stage involves a series of field reconnaissance visits to the regions. This includes an assessment of relevant collections and programmes of coastal survey concentrating on preliminary documentation of Ottoman-period buildings and sites of interest as well as their landscape contextualisation including an assessment of their location from a coastal process perspective. Survey will primarily be undertaken along the coastal strip in an attempt to identify hierarchies of coastal settlement types as well as past evidence of maritime infrastructure including ports, landing places, fishing stations etc.

The final stage of the project will be a focus on data analysis where the results of the literature and field survey will be compiled in a report and a digital map-based resource of Ottoman-period coastal archaeology will be generated as part of the second stage of the project. A number of sites and places will be selected for potential future intensive terrestrial and underwater survey, as well as limited excavation in phase II of this overall project.

Geology & Quaternary Environmental Change

Background

The Lebanese coastal strip is steep, narrow (1.5-10km) and bounded to the east by the Mount Lebanon range which rises to over 3000m altitude. The adjacent continental shelf to the west is similarly steep and narrow with the shelf edge (-200m) located between 2-15km offshore (Figure 1; Beydoun, 1976). This topography is a product of uplift and folding of the crust brought about by collision of the African and Arabian tectonic plates (Walley 1997; Homberg et al. 2010). Prior to uplift (during the Jurassic and Cretaceous periods), marine conditions dominated resulting in deposition of thick limestone sequences interspersed with thinner sandstone beds laid down during intervals of low sea-level and shelf emergence (Walley 1997).

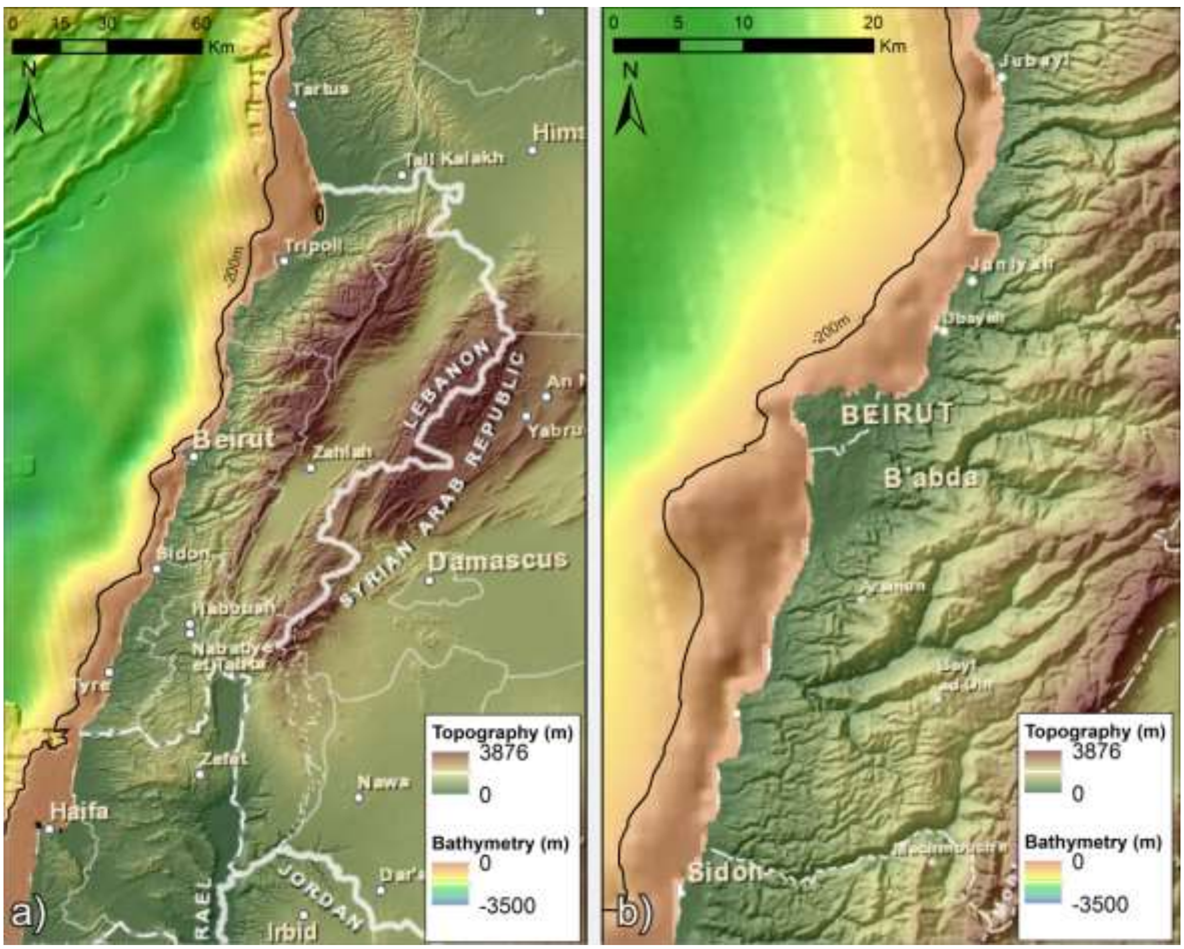


Figure 1. a) Bathymetry and topography of Lebanon with key place names. The -200m bathymetric contour has been added to show continental shelf width. b) Close-up showing sites investigated during the January 2014 fieldwork: Sidon, Beirut and Jubayl (Byblos). Topography data is from the NASA SRTM 90m global dataset, bathymetry is from the EMODNET Aegean-Levantine Sea dataset.

Major sea-level changes also continued through the Quaternary (last 2.5 million years) up to the present in Lebanon. The main process over this timescale was *glacio-eustatic* sea-level change: the removal/addition of water from the oceans driven by the growth/decay of continental ice sheets during cold glacial and warm interglacial intervals respectively. The magnitude of change was considerable;

although global sea-level rarely rose above present by more than several meters over the past 500,000 years, it fell by as much as -120m during glacial maxima (Figure 2; Rohling et al. 2009). Regional modification to this signal is caused by isostatic uplift/subsidence of the crust driven by changing ice or water loads on land or in the ocean basins respectively. However, in the Eastern Mediterranean, owing to its distance from the Northern Hemisphere ice sheets, this is generally of the order of a few metres; sufficient only to cause a minor deviation rather than a dramatic offset in the trend of sea-level change (Lambeck & Purcell, 2005). Thus, since the Last Glacial Maximum (c. 21ka), models suggest a trend of constant sea-level rise from a depth of c. -120m, reaching c. -45 to -50m at 12 ka and present levels by c. 6-7 ka (Lambeck & Purcell 2005). Directly-dated observational evidence of this rise which validates these models is currently lacking from Lebanon, except for evidence from the mid-late Holocene (post-6 ka). Geoarchaeological studies by Marriner et al. (2005; 2006; 2008) in Beirut, Sidon and Tyre, indicate marine transgression occurring between 8-6 ka at depths of -12 to -6m. Slightly earlier evidence comes from northern Israel which shows sea-level at c. -35m at 10ka rising to -16m at c. 9ka (Galili & Rosen 2011).

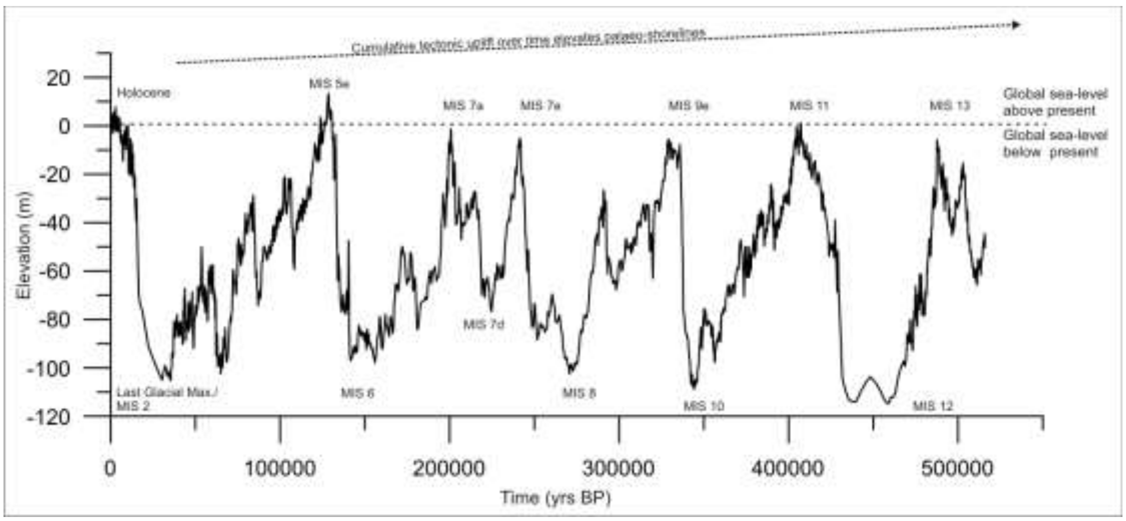


Figure 2. Global ocean volume change over the past 500,000 years. Note that this signal was regionally modified in Lebanon by long-term tectonic uplift such that previous highstand shorelines are located metres to tens of metres above present. Based on data from Rohling et al. (2009).

More important than isostatic effects in Lebanon are vertical crustal displacements driven by historic and ongoing tectonic processes along fault lines (Elias et al. 2007; Homberg et al. 2010). Their impact on local relative sea-level is well-documented in the form of raised shorelines of various ages. For example, Morhange et al. (2006) document two raised Late Holocene shorelines which have been sampled across the Lebanese coast; an upper (+1.2-1.4m above present (asl)) dating to 6-3 ka and a lower (+0.8m ±0.4m asl) dating from 2.7ka to the 6^{th} Century AD. Both shorelines are attributed to tectonic uplift (possibly earthquake induced: Elias et al. 2007) while decimetre-scale height variations between sample sites could indicate differential tilting or vertical movement between fault-bound crustal blocks. Marriner et al. (2006) also note that Tyre has Roman harbour features, walls and quarries submerged at c. -2.5m, and attribute this to subsidence of the local crustal block. Earlier 'staircases' of uplifted Quaternary marine terraces or beach deposits have also been recognized in Lebanon and potentially date back as far as c. 400ka (Copeland 2003; Pedoja et al. 2014). Elias et al. (2007) quote a maximum elevation of 500m for such features but in general they appear to be located up to several tens of metres above present sea-level (Copeland et al. 2003; Pedoja et al. 2014). These are generally interpreted as reflecting past

sea-level highstands which have subsequently been uplifted either by long-term motion associated with the formation of the Mount Lebanon range or the cumulative effect over time of short-term earthquake-induced events (Elias et al. 2007).

Field observations

Limited evidence of the above geological history was observed during the January fieldwork. Of the three areas visited (Beirut, Byblos and Sidon), no observations were possible at Sidon as the coastal strip was heavily built over. Even at Beirut, only the Ras Beirut headland was relatively exposed. At Byblos however, good coastal exposures were visible along the shoreline north and south of the modern harbour.

Beirut

Ras Beirut comprises a limestone headland protruding from the west side of Beirut. The flanking shoreline to the north comprises vertical limestone cliffs 30-40m high with two prominent stacks (Figure 3a). These show good exposures of Lower-Mid Cretaceous limestone deposited under marine conditions (Walley 1997). Smaller limestone exposures with embedded flint nodules are visible on the headland itself protruding through vegetation or more recent sediment. The headland dips southwest forming a series of rocky platforms at the shoreline (Figure 3b). However, dip is not constant, and there is an apparent terrace backed by a scarp between c. 10-20m asl (Figure 3c). Another potential terrace is present at the top of the headland between c. 20-40m. The precise form of these features cannot always be distinguished; parts are vegetated while there has also been major construction work in places, particularly at the top of the headland in the form of the main road. Construction is also evidence on the lower part of the headland where a large area has been excavated and levelled for the storing coastal defence tetrahedra (Figure 3d). It is likely that these terraces relate to uplifted Pleistocene sea-level highstands. Copeland (2003) identifies the lowest (c. 10-20m) as the Enfean/Namean terrace (c. 110-70ka: Shea 2003) and the upper (c. 35-40m) as Tayacian (c. 400 ka).



Figure 3a) Ras Beirut headland (left) and stack (right). Coastal defence tetrahedral are visible at the extreme left. b) Seaward edge of Ras Beirut headland showing limestone platforms dipping into the sea. c) Shoreline at Ras Beirut. The 10-20m terrace is formed by the relatively level grassed area. d) Area of headland heavily modified for storage of coastal defences.

Byblos

Coastal erosion to the north of Byblos (Saqiet Zaidane Bay) has created a series of exposures in the c. 10m high cliff backing the gravel beach. The cliff comprises limestone up to 2-5m high overlain by a conglomerate (Figure 4a). The strata dip south such that the limestone is highest at the northern end of the bay but not exposed at its southern end. Extant geological maps indicate that the limestone is a Lower-Mid Cretaceous marine deposit (Walley 1997). The boundary with the overlying conglomerate is sharp and often planar. The conglomerate ranges in thickness from c. 8-5m and comprises cemented sand and gravel layered into distinct beds of varying thickness. Clasts range from fine gravel to cobbles and small boulders with individual beds having varying degrees of sorting. The majority of clasts observed consisted either of limestone or flint and the vast majority are rounded to subangular (Figure 4b).

The clear lithological differences between the limestone and conglomerate together with the sharp boundary indicate deposition under different conditions. The limestone represents deposition under marine conditions while the conglomerate was laid down under varying energy conditions with low and high energy intervals represented by the sand and gravel beds respectively. Rounding of clasts indicates deposition in a watery environment; given the proximity to the sea and lack of large rivers, the most

probable explanation is a coastal/shallow marine environment. Given the frequent occurrence of raised Quaternary marine sequences in the Levant (see above), this raises the possibility that the conglomerate represents an elevated Pleistocene shoreline/coastal deposit. Whether this can be related to a specific sea-level highstand or series of highstands is presently uncertain.

South of the harbour, exposed bedrock consists of sandstone platforms and outcrops (Figure 4c). The age of these is uncertain as sandstones in the Levant could either be millions of years old, or Pleistocene (ie. tens to hundreds of thousands of years old) aeolian deposits which have been cemented into solid rock locally known as *kurkar* or *ramleh* (Beydoun 1976; Galili et al. 2007). Evidence of more recent Late Holocene sea-level changes, as recorded by Morhange et al. (2006) was also present in the form of marine platforms and notches raised slightly (c. 1m) above sea-level (Figure 4d).



Figure 4a) Sequence of conglomerate over limestone north of Byblos. Note the distinct beds of sand and gravel within the conglomerate. Limestone section is 2-3m high. b) Close-up of poorly sorted section of conglomerate showing the range of rounded clasts present (lens cap is 6cm across). c) Sandstone platforms south of Byblos. d) Raised marine notch and platform north of Byblos.

Contemporary Coastal Processes and Heritage Management

Context

As mentioned above Lebanon's Mediterranean coastline is formed by marine sediment and river deposited alluvium resulting in sandy embayments and rocky shorelines. Both geomorphological types are evident at the three study sites visited, Beirut, Sidon (Saïda) and Byblos (Jbeil). Coastal landscapes represent the interface between marine and terrestrial ecosystems and as a result are subject to important historical and contemporary human use. Sedimentary coastlines, however, are subject to the strongest human pressure and are also generally more vulnerable to climate change. High population concentrations and economic activities in coastal locations has resulted in what Makhzoumi et al (2012) calls 'coastalization' and according to Antipolis (2001) this is especially acute in the southern and Eastern Mediterranean. In Lebanon in particular this trend is demonstrated by the fact that approximately 55% of the country's 4.4 million population live in the coastal plain (this population figure is an estimate due to a lack of up to date census information and the influx of refugees into the county). Although the coast is the focus of commercial industrial activities with three quarters of the total national economic activity located in the coastal zone including the countries four main commercial ports (ELARD 2011) other activities, such as tourism, are also increasing.

In relation to coastal areas in particular, the most frequent problems resulting from these pressures include coastal erosion, salinisation of freshwater systems, loss of wetland and natural habitat, pollution and human-induced subsidence. The Mediterranean basin is widely recognised as particularly vulnerable to climate changes (Jeftic et al., 1992; Hoozemans et al., 1993; Nicholls et al., 1996). The most recent IPCC report (IPCC 2013) suggests that global mean sea level rise for 2081-2100 relative to 1986-2005 will likely be in the ranges of 0.26 to 0.82 m depending on exact location and varying RCP projection scenarios. The essential information from this is that although the exact figure is uncertain the trends indicate that sea level will rise resulting in increased coastal flooding risk. As a result most of the current stresses linked to the effects of high human pressures and increased urbanisation are expected to be intensified by climate change especially in coastal systems already under stress and where human activities have diminished natural and socio-economic adaptive capacities.

Study Sites

Saïda/Sidon

Saïda, located c. 45 km south of Beirut, is known for its diverse and rich cultural heritage and important relationship with the sea (Al-Harithy 2013; Rodier 2005; Jidejian 1971). More recent construction of the marine promenade and expansion of the port have resulted in a loss of sediment from the northern beach and the isolation of ancient Sidon city from the sea. The Medieval sea castle remains as a tourist attraction however the concrete port installations have 'ignored the impressive archaeological remains exposed at the site' (Fonquernie 1993). According to Marriner and Morhange (2008) some of the best preserved harbour structures on the Levantine seaboard have either been destroyed or covered over due to this modernisation. Figure 5-7 illustrates the change in coastal form between 1946 and 1994 while the large expanses of contemporary construction and a loss of the ancient coastal configuration is illustrated in figure 8. This modernisation limits interpretation of the area in terms of coastal evolution and general landscape assessment.



Figure 5. Aerial view of Saïda 1946



Figure 6. Aerial view of Saïda 1968. Note the construction of the new port south of the sea castle.



Figure 7. Aerial view of Saïda 1994. Note the changed coastal configuration south of the ancient city and new port construction indicating land reclamation activity.



Figure 8. View of urban sprawl surrounding Saïda from the Medieval sea castle, 2014.

Beirut

Similarly to Saïda phase one of the Beirut city centre Master Plan (1994 – 2004) has resulted in the completion of marine works, defence structures and sea promenades, the completion of the Beirut Marina, and major developments in landfill treatment and land reclamation (Figure 9). 73 hectares of land (SOLIDERE 2013) has been reclaimed from the sea for development along the Beirut coastline since 1994. This large scale development has severely altered the coastline and a large amount of evidence of maritime archaeological remains has either been altered or destroyed as a result.



Figure 9. Extensive development and land reclamation along the Beirut coastline (2014).

Byblos/Jbeil

Located 30 km north of Beirut, Byblos is one of the oldest continuously inhabited cities in the world, from 6000 B.C. to the present time (UNESCO 2010). The archaeological site was extensively excavated for over 60 years, between 1921 and 1983 and in 1984 it was listed as a World Heritage Site. Like Saïda and Beirut, Byblos has a strategic coastal location and confirmation of this is apparent with the presence of the Medieval towers and ancient port. Unlike the aforementioned sites the coastline of Byblos has not undergone the same level of urbanisation and construction although some illegal coastal recreation construction projects do exist. As mentioned above the archaeological site is located on a natural sand stone cliff flanked to the south by exposed sandstone platforms and outcrops (Figure 4c) and north (Sagiet Zaidane Bay) by a mixture of eroding limestone cliffs overlain by conglomerate and fronted by a sand and gravel beach. The western section of the archaeological *tell* is fronted by a c. 20m eroding cliff comprised mainly of loose sand and gravel (possibly fluvial Wadi deposits) and fronted by a sand and gravel embayed beach (Chamiyeh Bay). The region is exposed to strong waves, except in protected embayments and harbours and the prevailing wind, which is from SW, is the main generator of the waves which are strongest in winter (December-April). The tide is semi-diurnal but the amplitude is very low (20-25cm). Since the tidal amplitude is low in this region evidence from historical aerial photography suggests that the construction of the modern jetty adjacent to the ancient harbour may have modified the local currents and changed the focus of wave energy leading to the increased erosion within

Chamiyeh Bay by storm waves (Figure 10 and 11, note the reduced shoreface width at Chamiyeh Bay from 1967-1998).



Figure 10. Aerial view of Byblos 1967

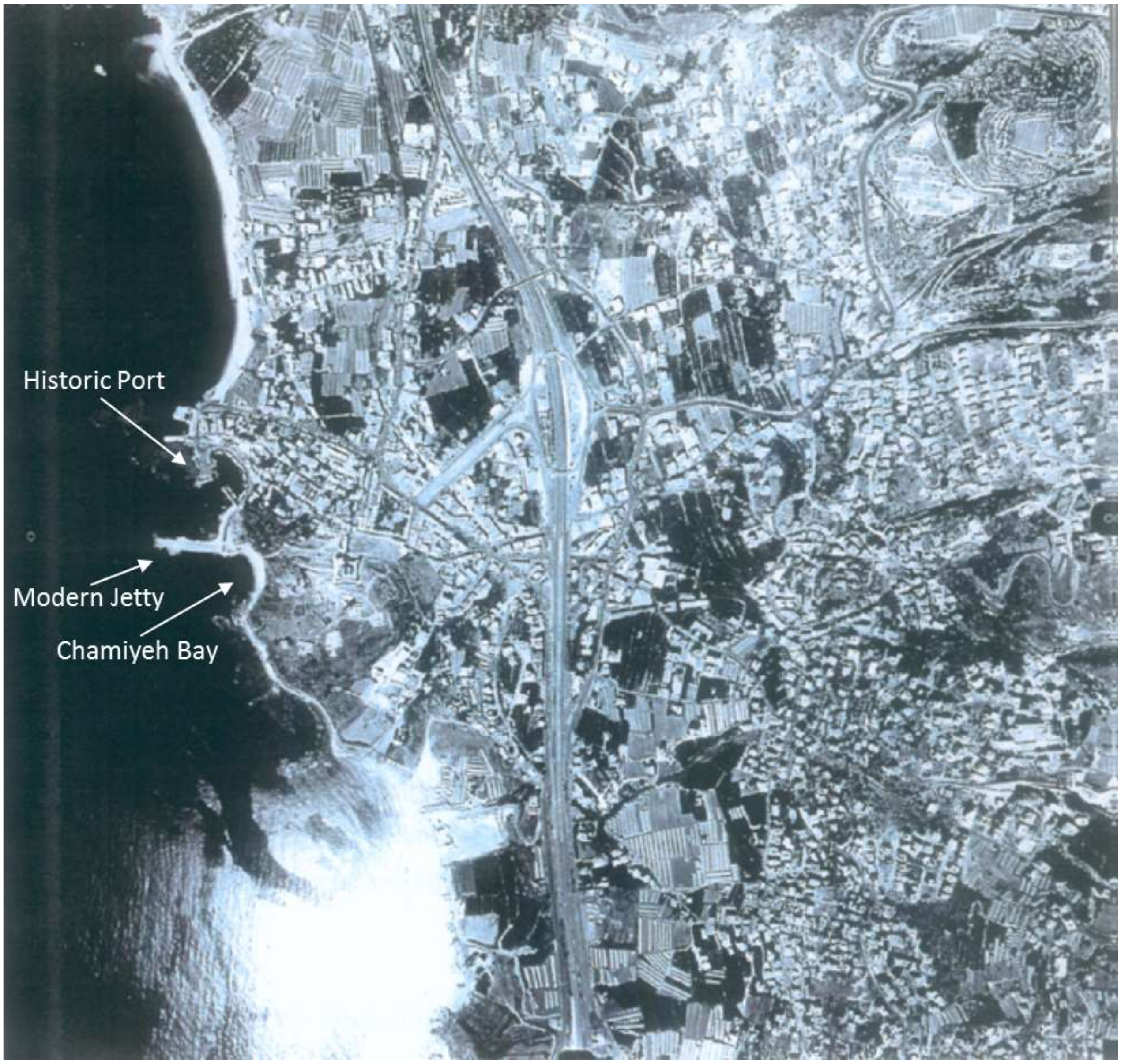


Figure 11. Aerial view of Byblos 1998



Figure 12. Eroding western edge of archaeological tell on Chamiyeh Bay, Byblos, 2014

The narrow embayed beach provides little protection to the western edge of the *tell* from storm waves and the construction of the jetty has modified the coastal configuration, perhaps exacerbating this problem (Figure 12). Some ad-hoc defence structures (rock revetments) have been put in place at either end of the Bay however this is likely to accelerate the problem as it will focus more wave energy into the exposed cliff face. Two options for future management of this eroding section of the heritage site are available:

1. Do nothing
2. Defend the site through either hard or soft coastal engineering (e.g. seawall, offshore breakwater, beach nourishment)

The selection of option 1 would result in the gradual loss of some of the archaeological site however this would create new exposures of the site. If monitoring and surveying programmes were put in place this could provide a new opportunity to learn about the occupation of the area and expand our knowledge of how past populations adapted to environmental change. Allowing the coastline to naturally adapt will also ensure that the embayed beach feature remains as a resource for recreational use.

Option 2 would be costly and as a result of previous coastal configuration changes the site may not revert to a state of equilibrium, this will also be influenced by the additional impacts of sea level rise. It is probable that storm waves, similar to those which damaged the new jetty in recent years, would also result in the destruction of any newly constructed man-made defensive measure or they would at least would require costly and regular maintenance. The selection of a defence option would also lead to the loss of the naturally forming embayed beach (Chamiyeh Bay) over time and accelerated erosion adjacent to the defensive structure.

An Archaeological Context

Saïda/ Sidon

Ottoman Period Saïda/ Sidon

Sidon was one of the most important port towns of the Eastern Mediterranean. An important Phoenician city state it was taken by Alexander the Great in 333BCE and later became an important Roman colony. Partially destroyed in the earthquake of 551 it came under Arab rule in 636 AD. It was taken by the Crusaders in 1110 AD and now became a central lordship under the Lordship of Jerusalem. Attacked by the Saracens and Mongols in the 1240s and 1260 respectively before it became part of the Mamluk territories across this littoral. With the onset of Ottoman rule Saïda began to develop rapidly. During the reign of Emir Fakhreddine II (1572-1635) much of the town was rebuilt and it was redeveloped as one of the primary ports servicing Damascus. European traders also began to develop warehousing facilities at the port from 1612. Amongst the structures erected during this period was the Khan Al-Franj, or French Caravanserai. This would have been built right on the waterfront and one of its two primary entrances led directly to the area of the old port. However, once conflict with Egypt began to escalate after 1770 and the expulsion of French traders in 1791 Saïda's position became tenuous and more emphasis began to be placed on Beirut.

The waterfront of Sidon is dominated by the Crusader castle initially constructed in the 13th century after 1227 and later modified to include enclosing walls and a rib-vaulted hall (Boas 2006). The medieval walled town would have fronted directly onto the port and sheltered harbour area in use since at least early Classical times. During the Mamluk period a sea gate was redeveloped and a main internal artery lead to this waterfront area. This entire zone was substantially redeveloped during the early Ottoman period exemplified the remodelling of the sea-castle and the construction of the caravanserai. A new mercantile zone was created and later a series of arch fronted warehouses and display areas was built to the north of the castle area. The internal souk and primary port artery was also redeveloped to facilitate this increased emphasis on commodification and the centralisation of trade activity.

In recent decades following the cessation of the civil war the waterfront has been extensively rebuilt and large portions of the original harbour area has been filled in.

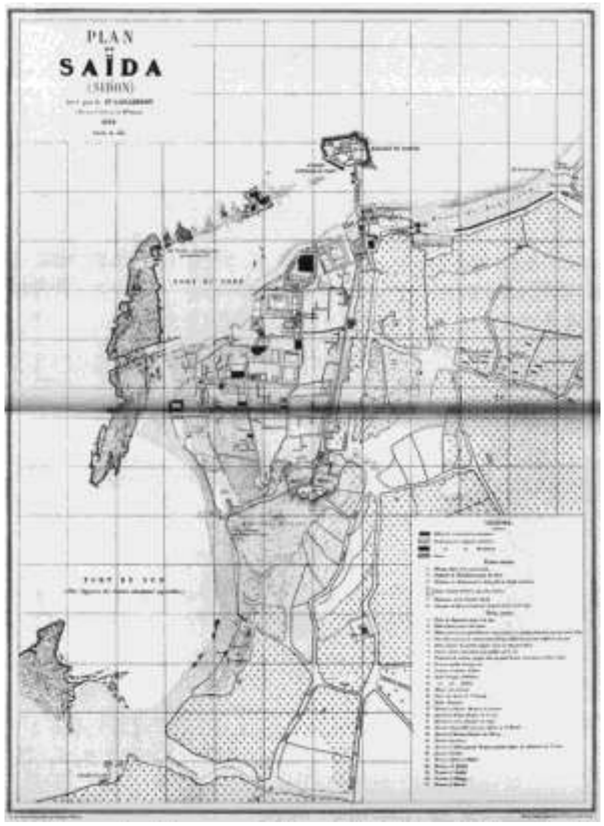


Figure 13: Saïda 1864



Figure 14: Saïda in the early 19th century.

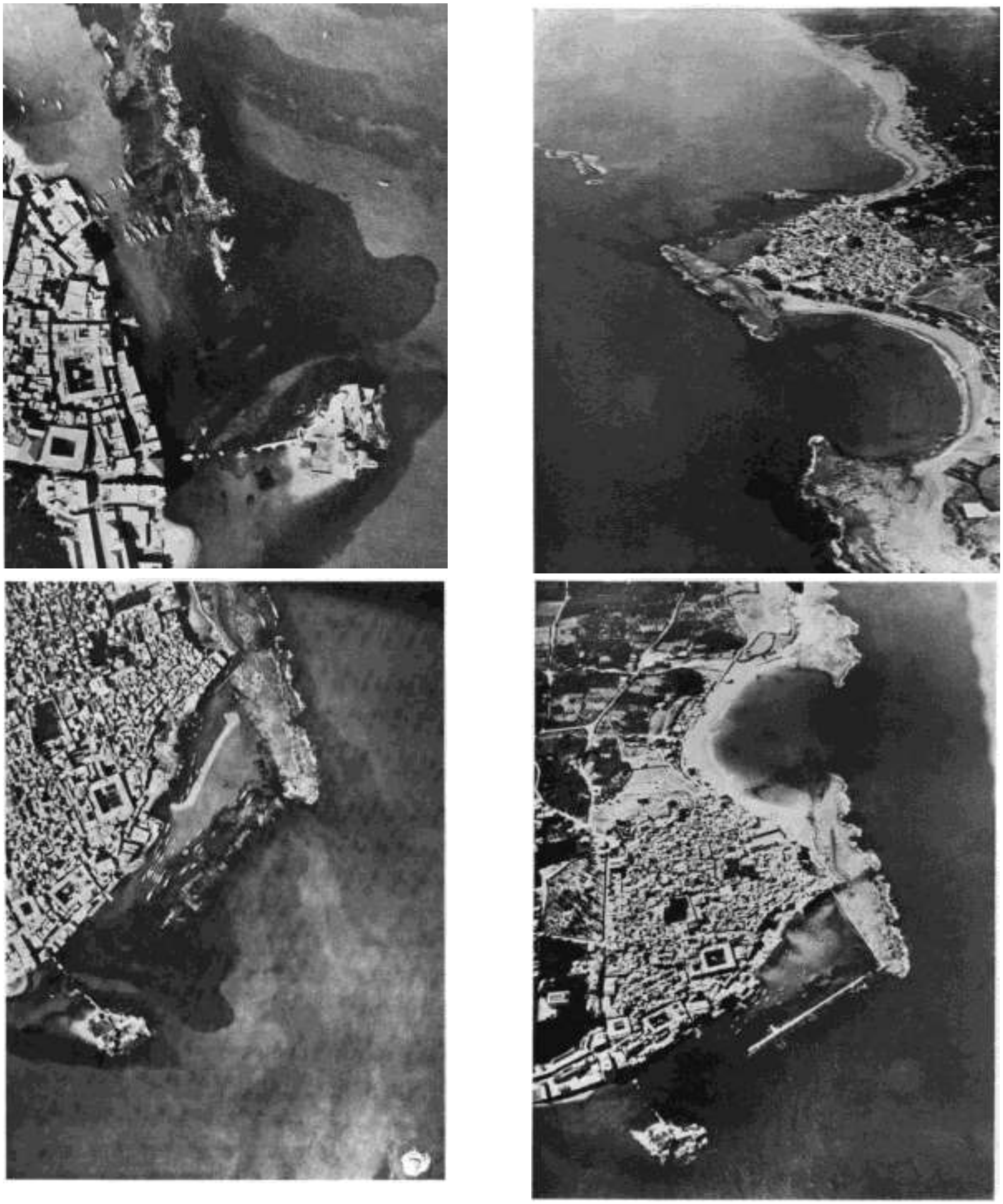


Figure 15: Saïda 1934-6 from Saïda - Etude Aerienne, au Sol et Sous-Marine, A. Poidebard & J. Lauffray 1951

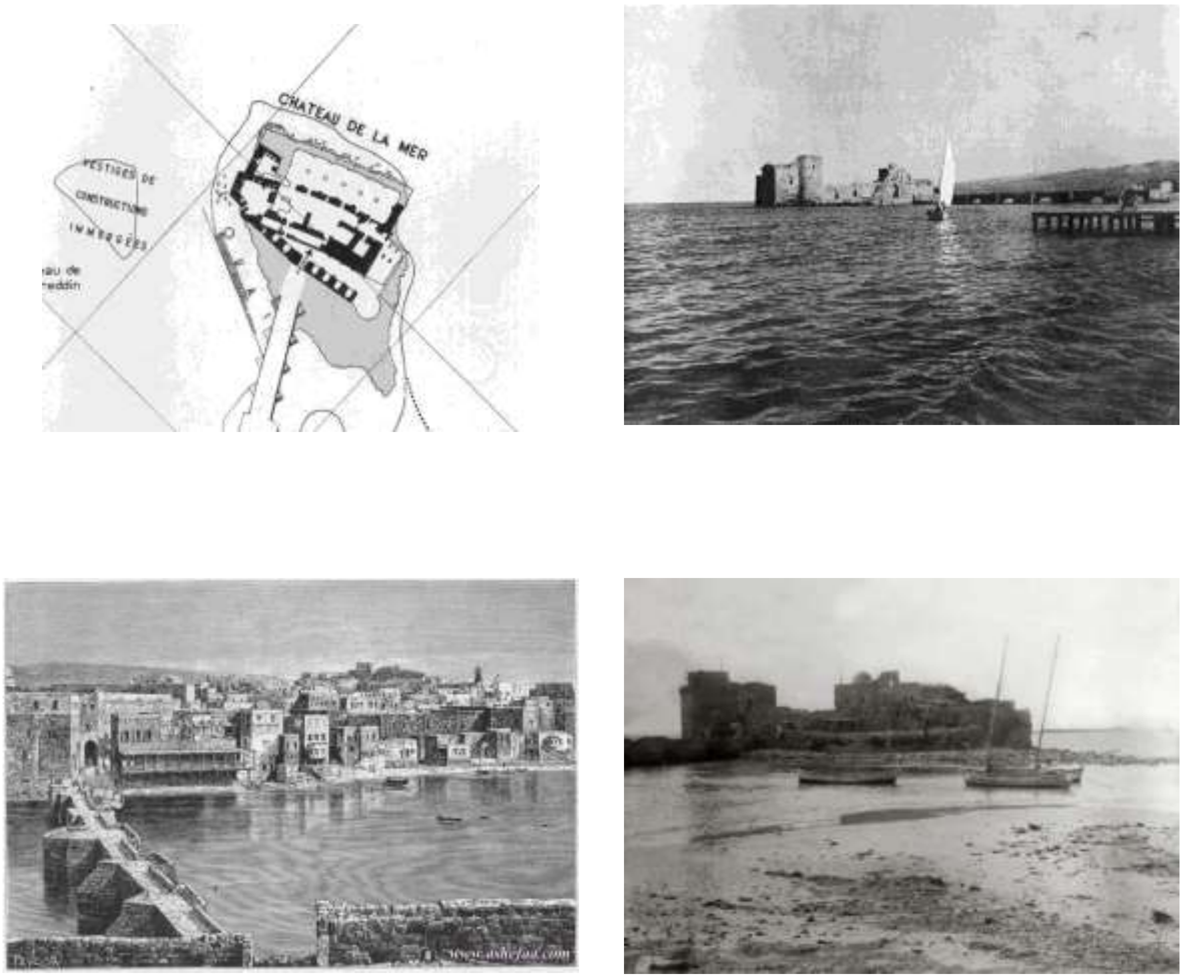


Figure 16: Plan and early 20th-century images of the Sea Castle at Saïda

Beirut

As with most port towns of the region Beirut has a long history. Occupied variously during the Phoenician, Hellenistic and Roman periods it came under Arab control in 635CE. Somewhat overshadowed by Acre as a trading port during the Middle Ages it was taken by the Ottomans in 1516 and continued to operate as a port servicing Damascus. Due to changes in the Asian caravans and a shift in trade northwards to Aleppo the town went through a period of decline in 17th and 18th centuries but began its emergence as the dominant regional port in the 19th century and its appointment as capital of the Vilayet of Sidon, an Ottoman administrative province, later becoming capital of the larger Vilayet of Syria in 1888. Associated development gradually encroached on its medieval waterfront and late-19th/ early 20th-century development filled in the former harbour area and concealed the former waterfront. Ibrahim Pasha commenced the construction of an enclosed basin in the 1830s which was enlarged in 1887. During the French Mandate a massive wall was extended from this to create a jetty extending for over 800m seawards. Significant development after the end of the civil war has resulted in massive port development and major infilling of a large area of the former anchorage. From at least the Crusader Period the port was protected by two towers described as being ‘of Genovese origin by Rey in 1871.

In 1212 Wilbrand of Oldenburg described the castle ‘On the lowest part it is fortified by the sea and precipitous rocks, on the other, by a ditch and walls (...) Two strong walls overlook the ditch, in which towers have been powerfully erected (...) the stones of which are linked by great iron bars. In one of the towers recently built (...) (was) a most ornate palace. It is well planned and sited, looking out on one side to the sea and the ships leaving the harbour, on the other on meadows, orchards and very pleasant places. In the midst of the palace is a well (...) and from it a fountain rises into the air..." (Boase 1967 :65). Ghillebert de Lannoy subsequently described the same castle in 1422 as lying on ‘the other side of the port…. is a small castle, built on a rock rising from the water….. Towards the meadows, it is also built on a rock. There one can see two ditches, without water. However, towards the sea, this ditch ends under the cliffs of the castle. On this rock, there are two square forts, one nearer the sea than the other, and surrounded by walls’ (Davie 1987). Both had effectively being destroyed by the end of the 19th century and are no longer visible. The surviving portions of the former port and harbour area are now buried but recent excavations have shown that considerable portions of the monumentality of these features still survive.



Figure 17: Panoramic view of Beirut dating from the later decades of the 19th century from the Maison Bonfils firm.

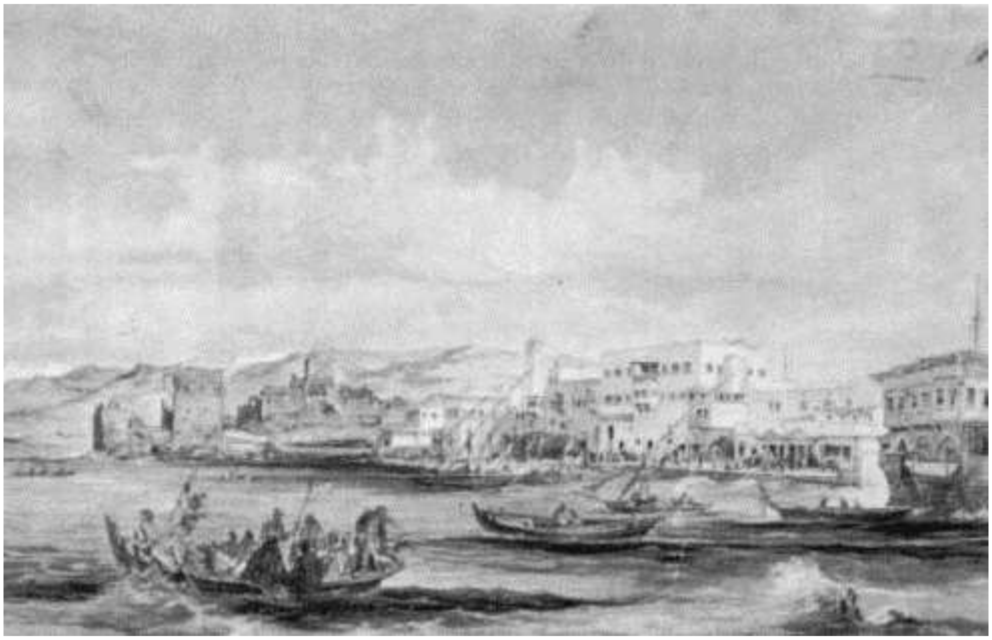


Figure 18: 'The Island Castle (left) and Main Castle (centre) and the quay of Beirut in the 1860s'



Figure 19: Beirut in 1841 (Davie 1987)

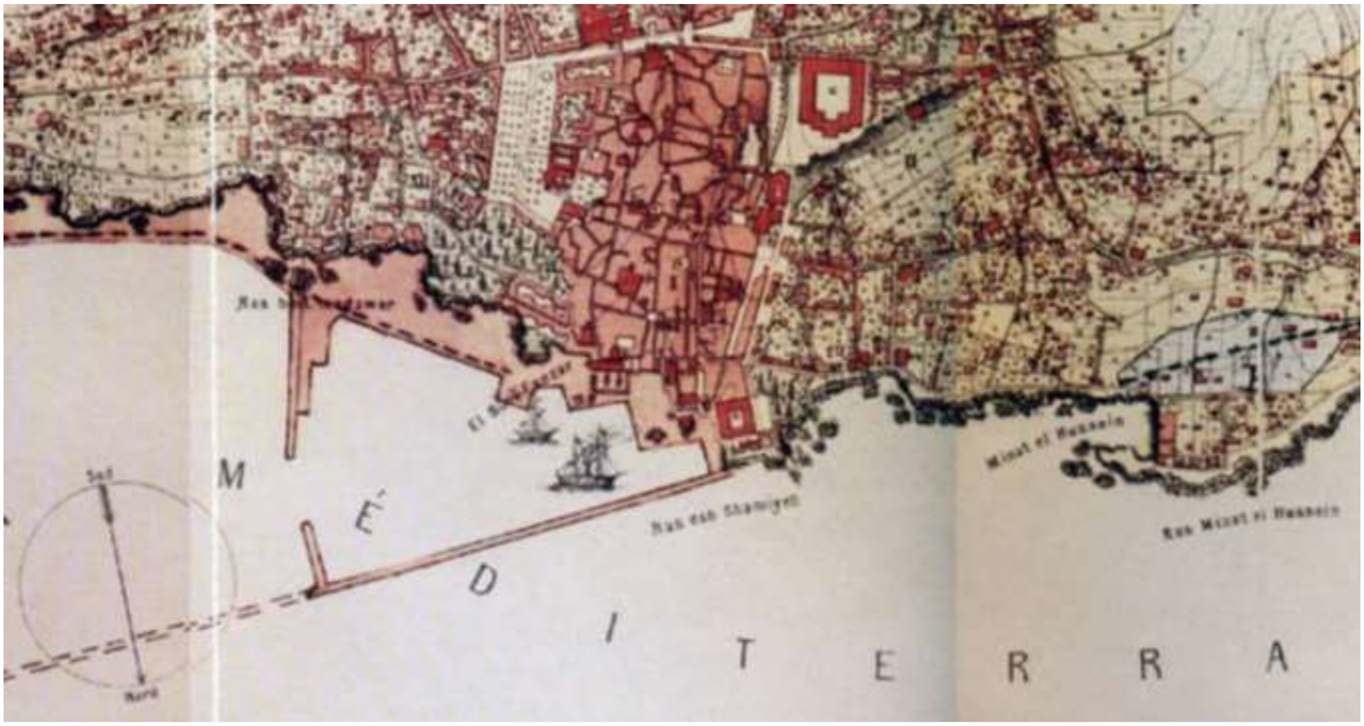


Figure 20: 1876 Map of Beirut by Julius Loytved and includes plans for the further reclamation of large areas of foreshore.



Figure 21: 1936 map of Beirut illustrating the extent of port development that had taken place by that date (Bureau Topographieque des Troupes Françaises de Levant, November 1936).

Byblos

Introduction

Byblos is an ancient seaport located approximately 30km north of Beirut. A major archaeological site, it has revealed Neolithic, Bronze Age, Classical era and Medieval evidence (Cauvin 1962; Boyton 1960; Nigro 2007; Jidéjian 1968). Indeed it claims to be one of the longest continuously occupied urban areas in the world. Byblos was the principal Phoenician port with major exports in cedars and papyrus. It became hellenized after the conquest by Alexander the Great, and from 64BCE became a Roman colony. The Romans made amendments to the street plan and built temples, baths and gardens. The Byzantine Empire in turn controlled the city from 395-637 CE, after which it fell into significant decline under Muslim rulers. This made it easy prey for the Crusaders in 1098, after which it reverted to Muslim rule.

The first archaeological excavations at the site were by the French historian Ernest Renan, in 1860. Pierre Montet excavated from 1921-4, and Maurice Dunand conducted several campaigns over nearly fifty years. Much of this work has focused on the prehistoric and classical eras with almost nothing on medieval or later phases. The site was registered by UNESCO in 1984 as a World Heritage Site. Since its initial designation there have been proposals to extend the protected area to the old souk and Roman streets (see UNESCO/DUT 1999).

Terrestrial archaeological remains

The key archaeological monument in Byblos is the extensive complex to the immediate south of the harbour, which contains Neolithic houses and later prehistoric houses, Phoenician and Roman temples and amphitheatre, a 12th century Crusader castle and city wall (Figure 22).



Figure 22. The archaeological complex at Byblos featuring (TL - clockwise) Roman temple, crusader castle, extensive wall and houses, the amphitheatre

Beyond this site in the old town is St John the Baptist church (12th century), the old souk, and the medieval harbour and castle (Figure 23). While walking through the town on the present survey, a number of exposed sections were evident in the vicinity of built structures. These revealed significant quantities of ceramics and clearly indicated that the historic settlement extended a good deal further than the current boundaries of 'known' historical monuments (Figure 23). As a result the coastline north was carefully examined for evidence of occupation layers (see Westley, this report).



Figure 23. Clockwise TL - St John the Baptist church; the old harbour and castle; exposed structures and ceramics within the town.

Maritime archaeological remains

The maritime archaeology of Byblos can be examined by consideration of three environments – the coastal fringe, the intertidal zone and the subtidal zone:

i) The Coastal fringe

Much of the coastline of the area is heavily developed or urbanised. Indeed the coastline between Byblos and Beirut is very heavily impacted by development. This has reduced the potential for upstanding archaeological monuments, and equally presents difficulties of detecting and accessing buried remains. Within Byblos the coastal fringe around the main archaeological complex, the harbour and along the Baie de Saqiet Zaidane were inspected. The coast below the archaeological complex is soft and full of redware ceramics. The site is under active threat – walls are exposed in section and part of the light railway used to move spoil in the early 20th century is exposed (Figure 24). A number of circular pits have also been cut into the rock at the base of the cliffs and lined with lime mortar. The fact that these have not been noted in archaeological literature implies they are relatively recent features. A 'sea door' at the base of the cliff (see Carayon 2013, Figure 3) is still evident, although the collapse from the slope above threatens to engulf it. The area to the north of the harbour – Baie de Saqiet Zaidane - is soft, limestone and conglomerate cliff being actively undercut. However, no archaeological finds were observed eroding from the cliffs in this area.

The harbour structure, some of the buildings to the rear and lining the old streets are of interest and may be of relevance to a study of Ottoman-era investigations. They likely functioned as warehouses, customs and other infrastructure associated with the mercantile activity of the port. The harbour walls feature reused classical era columns, and these are also evident in the intertidal zone (see below). The fortification at the entrance to the harbour is a further element that is in danger due to its exposed position. The western (seaward) side of the building has weakened masonry that requires attention.



Figure 24. Clockwise TL – The 'Sea door'; an eroding face leaving wall and light railway track exposed; column and quarried bedrock in the old harbour; stone anchors etc. above the old harbour.

ii) The intertidal zone

The intertidal features include a causeway to the islet at the south of the main tell, this is composed of large cobbles and boulders. In addition there are structures on low, offshore rock platforms to the west of the town. Given the tendency for Levantine harbours to employ offshore reef systems, these are of obvious interest. Below the archaeological complex are the steps and tombs noted by Carayon (2013). These rock-cut features are heavily pitted by sea action. A further area of interest is close to the old harbour – beyond the entrance to the south are a series of columns and basins in the water that are classical in origin (Figure 24). The intertidal bedrock here also appears to have been quarried and cut to produce a flat platform with a block-like surface.

iii) The subtidal zone

An underwater survey was beyond the scope of the current survey, however proposals to create a new harbour to the south have prompted work by a French mission to assess the seabed. As late as 1999 it was claimed that the seabed was completely unknown in cultural terms (UNECO/DUT 1999). Honor Frost had noted evidence for sea level change in the form of submerged ridges at 25 and 30m (*ibid*.; see also Marriner et al. 2005; 2006; 2008). A further strand of evidence also relates to the work of Honor Frost – the local sea food restaurant (Pepes) has a small adjoining private collection which includes column fragments and capitals, stone anchors and bronze anchors – many of the latter were donated by Frost, although their exact provenance is not clear (Figure 24).

Ottoman-Period Byblos (Jbeil)

The published guides and sources to the town essentially talk about the demise of the town following the departure of the Crusaders. One text states that Byblos 'continued under Mamluk and Ottoman rule as a small fishing town, and its antique remains were gradually covered with dust' (Lebanon Ministry of Tourism 2013). This concept of almost inevitable decline is a feature of the narratives associated with nearly all of the coastal ports. This misconception is repeated in many published texts and fails to recognise the new cultural dynamics that were introduced during this period. Mamluk investment in Tripoli, for example, illustrates the extent of investment and redevelopment that was undertaken during the medieval period (Salam-Liebich 1983). There is a degree of debate about whether there would have been a southern harbour at Byblos during earlier millennia. Regardless of this the medieval and early modern port was centred on the current port basin. The primary defensive feature was the small tower located on the northern entrance promontory to the port. This was originally (re)constructed during the Crussader period as evidenced by its large basal building blocks and inclusion of classical-period columns in its wall facing. The structure would have functioned as a guard tower and probable administration building for the port and acted as a subsidiary structure for the large citadel to the south. The building was later refurbished during the Mamluk period. Large-scale redevelopment of its exterior walls took place and the internal area was also largely rebuilt with the insertion of pointed arches. It is unclear as to the extent of any work that took place during the Ottoman period but it does appear that the building remained in use and that there was a degree of repair and maintenance undertaken. By this time it is likely that it would have accommodated a small port garrison. The structure was later effectively rebuilt in the 20th century.



Figure 25: Aerial photograph of Jbeil in the early 20th century (probably October 1927).

The key surviving features of the medieval port are a complex of semi-fortified warehouses that are located in the south-eastern quadrant of the basin. These are currently occupied by a restaurant and small museum. This would have constituted the core mercantile area of the port and these buildings were constructed at the port end of the road system that led directly to the citadel and the core administrative, political and military centre of the town. The northern surviving (restaurant) complex

would originally have consisted of a rectangular building block housing up to seven individual merchants 'shops' and dates to the Mamluk period. Each compartment consisted of a barrel arched structure with a single entrance door. These were located on the upper floor and were built over a well- built series of storage areas. A later block, contained two further arched spaces, was constructed at the southwest angle to the original medieval complex. This is likely to date to 17th or 18th centuries and was part of the Ottoman redevelopment of the town. Similarly, large building block, currently housing a police station, was constructed immediately to the west of this latter block on the same general orientation and would appear to date to the 18th or early 19th century on the basis of its architectural features including general morphology and side arches. This coincided with a broader period of redevelopment including the renovation of the Mosque of the Sultan Abd el-Majiid built on the site of an earlier mosque in 1648, renovated by Emir Youssef Chehab in 1783. The original mosque building is earlier and dates to the Mamluk period. The old souk immediately outside the adjacent city gate was also developed during the Ottoman period and consists of a series of mercantile apartments measuring c.4m x 9m with an internal barrel-vault and flat roof. This was later superseded by larger commercial development along the old Roman road during the 19th century.



Figure 26: The citadel at Jbeil, 20th October 1927

Spatial development of town, dedicated mercantile space, associated political/ administrative space centred on the citadel. Elite residential space within the walled town, continued upkeep of the walls was designed to delineate this space as well as providing a degree of protection.



Figure 27: 1871 a.Plan of Byblos/ Jbeil, b. map of the medieval walled port town of Byblos (Lebanon National Museum), c. Eugene Flandrin's 1840 sketch of the entrance to Jbeil, d. 1920s aerial image of the waterfront at Byblos, showing the mercantile block in the lower left-hand corner.



Figure 28: Early 20th-century images of the harbour and souk at Jbeil/ Byblos

Emerging model

Many ports across this region were subject to centuries of development with particular periods of infrastructural construction taking place during the Roman period. But what of an emerging model for later medieval port towns that functioned as part of the Mamluk and later Ottoman territories? Soffer and Stern (1986) have suggested that a port sub-type of the traditional image of an Islamic city was specifically developed for the Eastern Mediterranean coast where older classical-period foundations were integrated into the medieval urban forms and associated social features that emerged during the

Islamic period. Here, a dual orientation existed on both the harbour and the urban social and religious spaces. To what extent this was driven by theoretical Islamic requirements is debatable. Of course elements of newly Islamised society would invariably be incorporated into the urban landscape including a centralised citadel, mosques, elements of specialised souk areas and changing domestic forms. Across many cities citadels were emerging as places of habitation, defence and administration for the elite (Lapidus 1967). In the fourteenth and fifteenth centuries the patronage of hospitals within the area of the city also emerged as a religious act of charity by rulers but can also be seen as an overt demonstration of power. Finally the provision of caravanserai as rest places for merchants can also be seen as an intrinsic component of these urban centres. The concept then of a formalized single uniform Islamic city plan is not tenable but a number of common characteristics and morphological arrangements can be seen.

This study has highlighted a number of common characteristics. Each of the ports has been adapted to its local morphological conditions. These, for the most part, had been selected in antiquity and took advantage of natural basins or embayments. Each of the sites has a dedicated tower or small castle situated within the port and this would have functioned not only as a defensive entity but also an administrative space within the port zone. These would have been subsidiary to a larger terrestrial citadel located within the adjacent town. Each of the ports has a mercantile zone fronting onto the waterfront and this would have accommodated both warehouse storage units and 'shops', the earliest of which survive at Jbeil. An elite residential space was also associated with this space. A number of the ports also have associated khans, the most notable survives at Sidon. It is important that continuing survey work of this kind is developed across the region to see if this emerging spatial pattern is present across the Eastern Mediterranean.

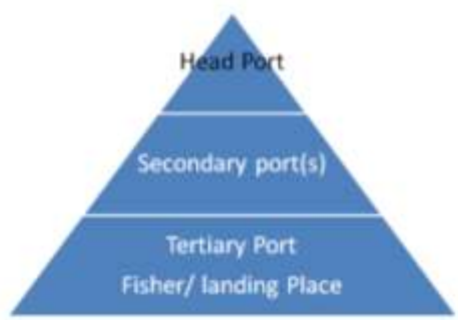


Figure 29: Model of an emerging hierarchical port system in the study area

Museums and Ottoman/ Mamluk Heritage

Museums have been used to construct and create visual representations of regional or national identities and produce narratives of a country's national story (McLean 1998; Mason 2007). Researchers will also argue that museums and other forms of heritage institutions and manifestations have often been used to propagate, or at least providers, of a nation's 'origin story' or 'origin myth(s)' (Graham and Ashworth 1994). Heritage can be further used to store or shape a nation's collective memory and shape the central narratives that are used to from and define a group of peoples. Similarly the construction and shaping of social cultural space can be driven by political or social agendas and can be manipulated to suit particular narratives or cultural discourse. It is then interesting in this context to address how both the Ottoman and Mamluk periods are presented in the museums of Lebanon.

The National Museum is located in Beirut. First opened in 1942 it is the primary repository and museum of Lebanon's national archaeological heritage. The primary emphasis within the collections is on the prehistoric and classical periods with both the Mamluk and later Ottoman period afforded little space and attention. This is a pattern replicated across the broader geographical region and is interesting in terms of how both archaeology is defined in a temporal sense but also in terms of the relatively subjugated role the Ottoman period is assigned to in terms of interpretations of modern Middle Eastern States. One small gallery section at the end of the museum 'trail' is entitled 'From the Arab Conquest to the Mamluk Period' and covers the years 635-1516 AD. It is accompanied by a brief narrative documenting the Arab conquest from the fall of Baalbek in 635 and the introduction of the Omayyad Period following the sixth-century earthquakes. The Crusader period lasted from 1099-1289 before the Mamluk Sultan Baibars ends their rule of the coastal territories and begins a period of intense investment in civil and religious buildings including mosques, madrasas and hammams. The display cases include a section dedicated to coins including thin gold and copper coins. A second pottery display includes a number of pilgrim flasks dates to the 13th and 14th centuries as well as six glazed Ottoman-period terracotta coffee cups from Beirut and 13th-century glazed pottery. Two further display cases show Mamluk material dating from 1289-1516. The Ottoman period displays across the whole museum then amount to six cups associated with the ubiquitous coffee industry.

In this context the Sidon Soap Museum was of most relevance. The museum highlights the direct relationship between the Audi family and the Ottoman past. It is housed in one of the family's former residences and chronicles the process of historic soap making and displays the artefacts recovered from the excavations that took place at the site in advance of conservation and museum development. The soap factor itself is indicative of a movement during this post-medieval period towards industrial scale processes and is typical of the large-scale commodification of goods that is present across the region at this time. The museum places a heavy emphasis on the display of the recovered material culture including pipes and ceramics but carries little in the way of the social interpretation of this material.



Figure 30: Ottoman period pipes and ceramics from the excavations conducted at the site of the Sidon Soap Museum

Maritime Heritage management

To date management of heritage sites and often in particular maritime heritage sites has been fragmented and approached in a compartmentalised manner. From their work in Australia Rowland and Ulm (2012) note, heritage sites, particularly in coastal settings are dynamic and are modified and often destroyed by a range of processes. The destruction of sites either by increased urbanisation, sea level rise and coastal erosion is already a major problem not only in Lebanon but worldwide. Heritage sites are 'non-renewable' and ongoing environmental changes and increasing human development will continue to impact on heritage resources.

In Scotland archaeologists have attempted to evaluate the effects of coastal erosion on coastal archaeological sites and have salvaged the most important sites threatened by erosion (SCAPE 2009). This method was often used in the past for threatened sites however since the 1970's emphasis was placed more on conservation (Cultural Resource Management) rather than salvage (Sullivan and Bowdler 1984). Coastal zones are often recorded on maps as precise lines but in reality they are highly dynamic and changing zones. With the continued impacts of climate change and human development putting more and more maritime archaeological sites at risk of destruction the debate over salvage/heritage conservation is one which may need reconsidered (Rowland 1999) as it is unlikely that in-situ preservation and 'holding the line' of maritime heritage sites can be maintained into the future.

In response to this and the knowledge that the Mediterranean Basin area is particularly vulnerable to climate change as well as being tectonically active an important first step would be to identify those sites most at risk and those which are culturally more significant. It would be costly, arduous and almost impossible to catalogue and maintain a register for all sites. However, at a regional or local scale anecdotal and observation data could be used to identify general trends in coastal evolution. This could be supplemented by information on development and urbanisation trends. Future heritage site management will require such an integrated landscape approach in order to both assess risk, and record the cultural heritage of sites. In the Mediterranean Basin where many important maritime heritage sites are under threat a risk assessment and monitoring/recording programme will be necessary to help identify and learn from as many sites as possible before they are destroyed due to environmental change or urbanisation. Programmes such as this could also draw information from this archaeological data to supplement our knowledge of coastal evolution. This landscape approach model would enable a multi-disciplinary contribution to research, expanding our knowledge about our heritage whilst investigating past and present environmental change.

Relationship to the full project

This project represents an important regional case study in the analysis of Ottoman-period maritime cultural landscapes across the eastern Mediterranean. This broader project is building towards developing a major study of the maritime archaeologies of this period across the region and will include further studies in southern Turkey, in Cyprus and at a number of locations across North Africa. The project is focussing on the direct coastal zone and examining the archaeology of settlement, trade, communications and defence on a macro-regional basis from 1500-1850.

Appendix 1

Prehistoric archaeology: submerged landscape potential

No direct investigation of submerged landscapes was undertaken in the January 2014 fieldwork. However, desk-based research, combined with geological and landscape observations made during the fieldwork have allowed the following comments on submerged landscape potential in Lebanon.

Lebanon has a rich and well-documented prehistoric record, with the earliest (Lower Palaeolithic) evidence dating back at least to MIS15 or 17 (c. 600-700ka). Sites from the subsequent Middle Palaeolithic, Upper Palaeolithic, Epipalaeolithic and Neolithic periods are also well represented (Yazbeck 2004). From a maritime perspective, an interesting aspect of the record is the strong presence of sites on the coastal strip including direct association of prehistoric material with the aforementioned raised shorelines (e.g. Copeland 2003). This was possibly apparent during the January fieldwork from several struck flints found on the Ras Beirut headland (Figure 5). They were found in disturbed context as construction work (creation of storage zone for coastal defences: Figure 3d) had cut into, and redistributed the natural deposits. The flints were undiagnostic secondary and tertiary flakes (one slightly water-rolled), but their general location (on a gentle slope between 10-20m asl - notwithstanding any redistribution) suggests that they could correlate with the Middle Palaeolithic Enfean/Naamean marine terrace (Copeland 2003).



Figure 31. Struck flints found at Ras Beirut, January 2014

Use of marine resources (e.g. fish/shellfish) is still an open question for the Middle and Lower Palaeolithic, but the implication is one of coastal proximity. Later sites, such as Ksar Akil (Upper Palaeolithic), have direct evidence in the form of shellfish remains (Douka 2011). This suggests that the Lebanese continental shelf was also occupied when exposed during sea-level lowstands. Shelf exposure occurred certainly during the Last Glacial (see above) and probably also during earlier glacials when global ocean volumes dropped by similar magnitudes (Figure 2; Rohling et al. 2009). It is also notable

that submerged prehistoric sites have been found off northern Israel which has a similar archaeological and palaeo-environmental history (Galili & Rosen 2011).

The potential for finding submerged prehistoric sites in a Lebanese context is mitigated by 3 factors:

1) Continental shelf morphology. The narrowness of the Lebanese shelf means that the extent of land exposed during sea-level lowstands was limited. Effectively, even at maximum lowstand, we are not dealing with a vast coastal plain like the North Sea or Adriatic, but an extended coastal strip which in turn limits the space available for occupation. The steepness of the shelf presents technical challenges in that much of it is beyond reach of conventional diving (c. 30-35m). The most comprehensive and effective investigations of submerged prehistoric sites to date, for example in the Baltic Sea (e.g. Andersen 2013) and Israel (e.g. Galili & Rosen 2011), have relied primarily on diving owing to the specialist skills needed for prehistoric site recognition, excavation and recording. All these skills are difficult to undertake remotely or with geophysical/geotechnical methods. That said, these latter methods are still essential in identifying and reconstructing former landscapes (see point 3).

2) Taphonomic factors. These refer to the physical processes responsible for the formation, preservation and destruction of archaeological sites or landscapes. For submerged landscapes, key processes include hydrodynamics (i.e. strength of waves or tides), sediment supply (i.e. burial versus erosion) and coastal/nearshore geomorphology (i.e. presence/absence of sheltering or protective features). The open, wave-dominated and generally rocky Lebanese coast combined with the lack of large river systems suggests that the chances of burial and preservation are reduced. Though this is almost certainly the case for some areas, it can be offset by localized geomorphology. This is demonstrated by the preservation of submerged Neolithic sites at depths from -1m to -12m off the Carmel coast of northern Israel (Gaili & Rosen 2011). Hydrodynamic processes are similar to Lebanon (open, large fetch, wave-dominated), but preservation potential has been enhanced by Quaternary sandstone ridges (locally known as *kurkar*). These are former aeolian beach ridges or dunes which, over time, have become cemented into solid sandstone. Due to changes in Quaternary sea-level, they are present both above, and below current sea-level (Galili et al. 2007). Sites situated behind these ridges are sheltered from wave erosion during sea-level rise, while sheltered lagoon-like conditions created during lower sea-level may also have been attractive for past coastal inhabitants (Galili et al. 1993). Similar ridges are present on the Lebanese coastline and shelf (locally known as *ramleh* rather than *kurkar*: Beydoun 1976), for example off Beirut, Sidon and Tyre harbours. In these cases, the natural shelter they provided has been interpreted as critical in the initial development of safe anchorages and ultimately major harbours (Marriner et al. 2005; 2006; 2008). Therefore, their existence increases the possibility that protected environments and hence preserved submerged prehistoric sites/landscapes are locally present on the Lebanese shelf.

3) Data availability. Submerged landscape investigation heavily depends on data from the continental shelf to assess archaeological potential and to guide underwater investigations. This includes both geological data on the seabed and sub-seabed, and archaeological data, such as chance underwater or intertidal finds. The latter provide direct evidence for the location of potential sites, while the former are essential in producing reconstructions of the past landscape and identifying high potential deposits (e.g. sediments deposited under terrestrial conditions). The present state of knowledge regarding these data is unknown or poorly constrained, certainly in terms of the published literature. Information is currently lacking on regional sea-level lowering preceding the mid-Holocene (beyond general global datasets) and on the nature and extent of Quaternary geomorphology and sedimentary deposits on the Lebanese shelf. In this regard, it is significant that Lebanon has recently completed a major offshore geophysical survey for oil and gas (http://www.lpa.gov.lb/index.php). Similar data have been

successfully used for archaeological purposes in the North Sea (e.g. Gaffney et al. 2007). The Lebanese datasets focus on the continental margin, too deep to be relevant to Quaternary landscapes. However, if offshore hydrocarbon exploitation takes hold, additional coastal or shelf infrastructure may be necessary (e.g. cables, pipelines, harbour expansion) which could generate additional geophysical data in nearshore areas that could be useful for archaeological purposes. It is also unclear whether there have been chance finds of submerged prehistoric material, either by diving or recovered by fishing or dredging. It is possible that this data does exist, for instance within national heritage or geological archives, but is not readily accessible.

Based on the above, there two possible routes to further investigation of Lebanese submerged landscapes.

1) Shallow water, local scale surveys. These would focus on likely areas of potential based on either on preservation factors (e.g. sheltered areas protected by bedrock ridges), chance seabed finds (if available) or where presently coastal or intertidal sites suggest the presence of archaeological material. Investigations could also focus on areas where the seabed is currently eroding and revealing the underlying buried deposits. Shallow water and relatively limited spatial scale means that these surveys can be accomplished with divers, though geophysical survey can also contribute. This largely follows the high successful approach used in Israel.

2) Shelf scale surveys. This approach utilizes marine geophysical (e.g. multibeam echosounder, sub-bottom profiler) and geotechnical (e.g. vibrocoring) techniques to map and sample the seabed and sub-seabed. The aim is to obtain data which can improve understanding of past sea-level change and palaeo-landscape extent and also identify preserved formerly terrestrial environments which could have been occupied. This largely follows the approaches currently underway in the UK (e.g. Gaffney et al. 2007).

These approaches are not mutually exclusive and ideally future investigations would progress using some combination of the two. For example, if water depth permits, then high potential deposits mapped by geophysics can be subject to dive surveys. Similarly, sites located by diving can then be subject to geophysical survey to obtain a wider picture of the former landscape.

Bibliography

Antipolis, S (2001) Urban Sprawl in the Mediterranean region. Mediterranean Blue Plan. (http://planbleu.org/sites/default/files/publications/urbsprawl_1.pdf) (accessed 28/05/2014)

Andersen, S.H. 2013. *Tybrind Vig. Submerged Mesolithic settlements in Denmark.* National Museum of Denmark and Jutland Archaeological Society.

Beydoun, Z.R. 1976. Observations on geomorphology, transportation and distribution of sediments in western Lebanon and its continental shelf and slope regions. *Marine Geology* 21: 311-324.

Boas, A. (2006). *Archaeology of the Military Orders: A Survey of the Urban Centres, Rural Settlements and Castles of the Military Orders in the Latin East (c. 1120-1291)*. Routledge.

Boynton, E.S. (1960) *The Ceramic Industry of Ancient Lebanon*. MA thesis, A.U.B.

Cauvin, J. (1962) Les industries lithiques du tell de Byblos (Liban), L'Anthropologie, vol. 66, 5–6.

Copeland, L. 2003. The Tayacian of the Cordon Littoral, Ras Beirut (Lebanon) and its relations with other Tayacian sites in the Levant. *Paléorient*. 29(2): 87-107.

Davie, M.F. 1987 Maps and the Historical Topography of Beirut. *Berytus* 35: 141-64.

Douka, K. 2011. An Upper Palaeolithic shell scraper from Ksar Akil (Lebanon). *Journal of Archaeological Science* 38: 429-437.

ELARD (2011) Vulnerability and adaptation of coastal zones. The European LEADER Association for Rural Development. Study by the Ministry of Environment with support from UNDP (http://climatechange.moe.gov.lb/viewfile.aspx?id=44) (accessed 28/05/2014)

Elias, A., Tapponnier, P., Singh, S., King, G., Briais, A., Daëron, M., Caron, H., Sursock, A., Jacques, E., Jomaa, R. & Klinger, Y. 2007. Active thrusting offshore Mount Lebanon: Source of the tsunamigenic A.D. 551 Beirut-Tripoli earthquake. *Geology* 35: 755-758.

Fonquernie, B (1993) Réhabilitation et mise en valeur du centre ancient de Saïda. UNESCO. In: Marriner , N and Morhange, C (2008) Preserving Lebanon's coastal archaeology: Beirut, Sidon and Tyre. *Ocean and Coastal Management*. 51(5): 430-441.

Gaffney, V., Thomson, K. & Fitch, S. 2007. *Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea.* Oxford: Archaeopress.

Galili E., Weinstein-Evron, M., Hershkovitz, I., Gopher, A., Kislev, M., Lernau, O., Kolska-Horowitz, L. & Lernau, H. 1993. Atlit-Yam: a prehistoric site on the sea floor off the Israeli coast. *Journal of Field Archaeology* 20: 133-157

Galili, E. & Rosen, B. 2011. Submerged Neolithic settlements off the Carmel Coast, Israel: cultural and environmental insights. In Benjamin, J., Bonsall, C., Pickard, C. & Fischer, A (eds.). *Submerged Prehistory*. pp. 272-286. Oxford: Oxbow

Galili, E., Zviely, D., Ronen, A. & Mienis, H.K. 2007. Beach deposits of MIS 5e high sea stand as indicators for tectonic stability of the Carmel coastal plain, Israel. *Quaternary Science Reviews* 26: 2544-2557.

Galili, E. & Rosen, B. 2011. Submerged Neolithic settlements off the Carmel Coast, Israel: cultural and environmental insights. In Benjamin, J., Bonsall, C., Pickard, C. & Fischer, A (eds.). *Submerged Prehistory*. pp. 272-286. Oxford: Oxbow

Homberg, C., Barrier, E., Mroueh, M., Muller, C., Hamdan, W. & Higazi, F. 2010. Tectonic evolution of the central Levant domain (Lebanon) since Mesozoic time. In Homberg, C.& Bachman, M. (eds) *Evolution of the Levant Margin and Western Arabia Platform since the Mesozoic*. Geological Society, London, Special Publications 341: 245-268.

Hoozemans, F.M.J., Marchand M. and Pennekamp H.A. (1993) A global vulnerability analysis, vulnerability assessment for population, coastal wetlands and rice production on a global scale, 2nd edition. Delft Hydraulics and Rijkswaterstaat, Delft and The Hague, The Netherlands, 1993.

IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535.

Jeftic, L., Milliman J.D. and Sestini, G (1992) Climate change and the Mediterranean. Edward Arnold, London, UK.

Jidéjian, N. (1968) *Byblos through the ages*, Dar al Machreq, Beirut.

Lambeck, K. & Purcell, A. 2005. Sea-level change in the Mediterranean Sea since the LGM: model predictions for tectonically stable areas. *Quaternary Science Reviews* 24: 1969-1988

Makhzoumi, J., Chmaitelly, H and Lteif, C (2012) Holistic conservation of bio-cultural diversity in coastal Lebanon: A landscape approach. *Journal of Marine and Island Cultures*. 1: 27-37.

Marriner, N., Morhange, C. & Boudagher-Fadel, M., Bourcier, M. & Carbonel, P. 2005. Geoarchaeology of Tyre's ancient northern harbour, Phoenicia. *Journal of Archaeological Science* 33: 1302-1327.

Marriner, N., Morhange, C. & Doumet-Serhal, C. 2006. Geoarchaeology of Sidon's ancient harbours, Phoenicia. *Journal of Archaeological Science* 33: 1514-1535.

Marriner, N., Morhange, C. & Saghieh-Beydoun, M. 2008a. Geoarchaeology of Beirut's ancient harbour, Phoenicia. *Journal of Archaeological Science* 35: 2495-2516.

Marriner, N. and Morhange, C. 2008 Preserving Lebanon's coastal archaeology: Beirut, Sidon and Tyre, Ocean & Coastal Management, Volume 51, 430-41

Morhange, C., Pirazzoli, P., Marriner, N., Montaggioni, L.F. & Nanmour, T. 2006. Late Holocene relative sea-level changes in Lebanon. *Marine Geology* 230: 99-114.

Nicholls, R.J. and Hoozemans, F.M.J. (1996) The Mediterranean: vulnerability to coastal implication of climate change. *Ocean and Coastal Management*. 31 (2-3): 105-132.

Nigro, L. (ed.) (2007) *Byblos and Jericho in the Early Bronze I*. Proceedings of the International Workshop held in Rome on March 6th 2007.

Pedoja, K., Husson, L., Johnson, M., Melnick, D., Witt, C., Pochat, S., Nexer, M., Delcaillau, B., Pinegina, T., Poprawski, Y., Authemayou, C., Elliot, M., Regard, V. & Garestier, F. 2014. Coastal staircase sequences reflecting sea-level oscillations and tectonic uplift during the Quaternary and Neogene. *Earth Science Reviews* (doi: 10.1016/j.earscirev.2014.01.007)

Rohling, E., Grant, K., Bolshaw, M., Roberts, A., Siddall, M., Hemleben, C. & Kucera, M. 2009. Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience* 2: 500-504.

Rohling, E., Grant, K., Bolshaw, M., Roberts, A., Siddall, M., Hemleben, C. & Kucera, M. 2009. Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience* 2: 500-504.

Rowland M. J and Ulm, S (2012) Key Issues in the conservation of the Australian coastal archaeological record: natural and human impacts. *Journal of Coastal Conservation.* 16: 159-171.

Rowland, M (1999) Accelerated climate change and its impact on Australia's cultural heritage. *Australian Journal of Environmental Management.* 6: 109-118.

Salam-Liebich, H. (1983) *The architecture of the Mamluk city of Tripoli.* Cambridge, Mass.

Schriwer, C. 2002 Cultural and ethnic identity in the Ottoman period architecture of Cyprus, Jordan and Lebanon. *Levant*, *34*(1), 197-218.

SCAPE (2009) The SCAPE Trust annual review 2008. Scottish coastal archaeology and the problem of erosion, St. Andrews, Scotland (http://www.scapetrust.org/pdf/SCAPEAnnualReview2010.pdf)

Seeden, H. & Thorpe, R. 1997 Beirut from Ottoman Sea Walls and Landfills to a Twelfth Century BC Burial: Report on the Archaeological Excavations in the Souks Northern Area (BEY 006). *Berytus*, *43*, 221-54.

Seedon, H. 2000 Lebanon's archaeological heritage on trial in Beirut; what future for Beirut's past. *Cultural Resource Management in Contemporary Society.* McManamon, P, and Hatton, A. Routledge, London. 168-187.

Shea, J. 2003. The Middle Palaeolithic of the East Mediterranean Levant. *Journal of World Prehistory* 17(4): 313-394

SOLIDERE, 2013 http://www.solidere.com/city-center/urban-overview/districts-main-axes/waterfront (accessed 28/05/2014)

Sullivan, S and Bowdler, S (eds) (1984) Site surveys and significance assessment in Australian Archaeology. Research School of Pacific Studies, Australian National University, Canberra

UNESCO/DUT (1999) *BYBLOS – LEBANON. Project Identification & Implementation*. Proceedings of the International Workshop held at Delft University of Technology in the Netherlands from 27 - 29 April 1999.

UNESCO (2010) Emergency safeguarding of the World Heritage Site of Byblos.

Walley, C. 1997. The lithostratigraphy of Lebanon: a review. *Lebanese Science Bulletin* 10:1.

Yazbeck, C. 2004. Le Paléolithique du Liban : bilan critique. *Paléorient* 30(2): 111-126.